

CLAIMS

1. A copper metallization structure, comprising:
a via hole extending through a dielectric layer over an underlying copper feature;
a metal nitride barrier layer formed on sides of said via hole including a bottom
5 side thereof; and
a copper layer formed over the barrier layer at said bottom side of said via hole;
wherein a crystallography of said copper feature is aligned with a crystallography
of said copper layer across said barrier layer at said bottom side of said via hole.
2. The structure of Claim 1, wherein defects of said copper feature are aligned
10 with defects of said copper layer across said barrier layer at said bottom side of said via
hole.
3. The structure of Claim 1, wherein said copper layer comprises a copper seed
layer overlaid with electroplated copper.
4. The structure of Claim 1, wherein said nitride barrier layer formed on said
15 bottom side of said via hole is no more than 1.5nm in thickness.
5. A copper metallization structure, comprising:
a via hole extending through a dielectric layer over an underlying conductive
feature;
a metal nitride barrier layer formed on sides of said via hole including a bottom
20 side thereof, wherein a thickness of said barrier layer at said bottom side of said via hole
is no more than 1.5nm; and
a copper layer formed over the barrier layer at said bottom side of said via hole.
6. The structure of Claim 5, wherein said thickness is less than 1.0nm.

7. The structure of Claim 5, wherein said thickness corresponds to no more than three cycles of atomic layer deposition of said metal nitride barrier layer.

8 The structure of Claim 5, wherein said copper layer comprises a copper seed layer overlaid with electroplated copper.

5 9. A method of forming a via structure in a dielectric layer having a via hole formed therethrough overlying a conductive feature beneath said dielectric layer, comprising the steps of:

 depositing a metal nitride barrier layer in said via hole by no more than six cycles of atomic layer deposition; and

10 depositing a copper seed layer over said barrier layer on sides and a bottom of said via hole.

 10. The method of Claim 9, wherein said no more than six cycles consists of no more than three cycles.

 11. The method of Claim 9, further comprising electroplating copper over said
15 copper seed layer in said via hole.

 12. The method of Claim 9, wherein said step of depositing a copper seed layer comprises sputtering.

 13. A method of forming a via structure in a dielectric layer having a via hole formed therethrough overlying a conductive feature beneath said dielectric layer,
20 comprising the steps of:

 depositing by chemical vapor deposition a nitride barrier layer in said via hole and having a thickness at a bottom of said via hole of no more than 1.5nm; and

 forming a copper seed layer over said barrier layer on sides and said bottom of said via hole.

14. The method of Claim 13, wherein said nitride barrier layer comprises a nitride selected from the group consisting of titanium nitride, tantalum nitride, and tungsten nitride.

5 15. The method of Claim 13, wherein said chemical vapor deposition comprises no more than six cycles of atomic layer deposition.

16. The method of Claim 15, wherein said no more than six cycles consists of no more than three cycles.

17. The method of Claim 16, wherein said no more than three cycles consists of no more than two cycles.

10 18. The method of Claim 13, wherein said thickness is no more than 1.0nm.

19. The method of Claim 18, wherein said thickness is less than 1.0nm.

20. The method of Claim 13, further comprising electroplating copper over said copper seed layer in said via hole.